CLAIMS

I/We claim:

[c1] 1. A method of depositing a layer onto a microfeature workpiece, comprising:

injecting a gas into a plasma zone in a vapor reaction chamber;

generating a plasma from the gas in the plasma zone that causes an electrically conductive material to be deposited on the microfeature workpiece and a window of the vapor reaction chamber; and

transforming the electrically conductive material on the window into a substantially dielectric material.

[c2] 2. The method of claim 1 wherein the conductive material deposited on the workpiece and the window comprises a metal, and transforming the conductive material on the window into a substantially dielectric material comprises changing the metal to a metal oxide.

[c3] 3. The method of claim 1 wherein the conductive material deposited on the workpiece comprises at least one of Ti, W, Cu, Al, Ni and/or Co, and transforming the conductive material into a substantially dielectric material comprises oxidizing the at least one of the Ti, W, Cu, Al, Ni and/or Co to form a metal oxide.

[c4] 4. The method of claim 1 wherein the conductive material deposited on the workpiece and the window comprises a metal, and transforming the conductive material on the window into a substantially dielectric material comprises changing the metal to a metal oxide by injecting a fluid comprising oxygen into the vapor reaction chamber.

[c5] 5. The method of claim 1 wherein the conductive material is deposited onto the workpiece and the window at a deposition temperature and the electrically conductive material is transformed into the substantially dielectric material at a maintenance temperature of 80% to 120% of the deposition temperature.

[c6] 6. The method of claim 1 wherein the conductive material is deposited onto the workpiece and the window at a deposition temperature and the electrically conductive material is transformed into the substantially dielectric material at a maintenance temperature of 95% to 105% of the deposition temperature.

[c7] 7. The method of claim 1 wherein the conductive material is deposited onto the workpiece and the window at a deposition temperature and the electrically conductive material is transformed into the substantially dielectric material at a maintenance temperature approximately equal to the deposition temperature.

[c8] 8. The method of claim 1 wherein the conductive material is deposited onto the workpiece and the window at a deposition temperature and the electrically conductive material is transformed into the substantially dielectric material at a maintenance temperature within approximately 50°C of the deposition temperature.

[c9] 9. The method of claim 1 wherein:

the conductive material is deposited onto the workpiece in a plasma deposition process comprising flowing a first gas into the reaction chamber during one interval, terminating the flow of the first gas, flowing a second gas into the reaction chamber during another interval after terminating the flow of the first gas, and terminating the flow of the second gas, wherein the plasma is generated from at least one of the first and second gases, and wherein the first and second gases react to form the conductive material on the workpiece and the window; and

transforming the conductive material into a substantially dielectric material comprises flowing a fluid containing oxygen into the reaction chamber.

[c10] 10. The method of claim 1 wherein:

the conductive material is deposited onto the workpiece in a plasma vapor deposition process comprising concurrently flowing a first gas and a second gas into the reaction chamber, generating the plasma from at least one of the first and second gases, and terminating the flow of the first and second gases; and

transforming the electrically conductive material into a substantially dielectric material comprises flowing a fluid containing oxygen into the reaction chamber.

[c11] 11. A method of forming a conductive layer on a microfeature workpiece, comprising:

depositing an electrically conductive material onto a first microfeature workpiece in a vapor deposition process by flowing a gas into a plasma zone in a vapor reaction chamber and transmitting an energy into the plasma zone via a window of the vapor reaction chamber, wherein the energy produces a plasma from the gas that results in a residual film having a first transmissivity to the energy being formed on the window; and

changing the residual film to have a second transmissivity to the energy.

[c12] 12. The method of claim 11, further comprising depositing the conductive material onto a second microfeature workpiece by repeating the vapor deposition process after changing the residual film to have the second transmissivity.

[c13] 13. The method of claim 11 wherein the second transmissivity is greater than the first transmissivity.

[c14] 14. The method of claim 11 wherein the residual film comprises a metal and changing the residual film comprises changing the metal to an oxide.

[c15] 15. The method of claim 11 wherein the residual film on the window comprises a metal, and changing the residual film comprises changing the metal to a metal oxide by injecting a fluid comprising oxygen into the vapor reaction chamber.

[c16] 16. The method of claim 11 wherein the residual film is formed on the window at a deposition temperature and the residual film is changed to have a second transmissivity greater than the first transmissivity at a maintenance temperature of approximately 80% to 120% of the deposition temperature.

[c17] 17. The method of claim 11 wherein the residual film is formed on the window at a deposition temperature and the residual film is changed to have a second transmissivity greater than the first transmissivity at a maintenance temperature of approximately 95% to 105% of the deposition temperature.

[c18] 18. The method of claim 11 wherein the residual film is formed on the window at a deposition temperature and the residual film is changed to have a second transmissivity greater than the first transmissivity at a maintenance temperature at least approximately equal to the deposition temperature.

[c19] 19. A method of depositing a material onto a microfeature workpiece, comprising:

depositing an electrically conductive material onto a first microfeature workpiece in a plasma vapor deposition process by flowing a gas into a plasma zone in a vapor reaction chamber and transmitting an energy into the plasma zone via a window of the vapor reaction chamber; and

increasing a transmissivity to the energy of a residual film of the conductive material formed on the window during the plasma vapor deposition process.

[c20] 20. The method of claim 19 wherein the residual film comprises a metal and increasing the transmissivity of the residual film comprises changing the metal to an oxide.

[c21] 21. The method of claim 19 wherein the residual film comprises a metal, and increasing the transmissivity of the residual film comprises changing the metal to a metal oxide by injecting a fluid comprising oxygen into the vapor reaction chamber.

[c22] 22. The method of claim 19 wherein the residual film is formed on the window at a deposition temperature and transmissivity of the residual film is increased at a maintenance temperature of approximately 80% to 120% of the deposition temperature.

[c23] 23. The method of claim 19 wherein the residual film is formed on the window at a deposition temperature and the transmissivity of the residual film is increased at a maintenance temperature at least approximately equal to the deposition temperature.

[c24] 24. In a method of depositing a conductive material onto a microfeature workpiece using a plasma vapor deposition process that forms a film of the conductive material on a window through which a plasma energy passes to generate a plasma, a process for refurbishing the window comprising transforming the film of the conductive material on the window to be a different material having a higher transmissivity to the energy than the film of conductive material.

[c25] 25. An apparatus for depositing a material onto a microfeature workpiece, comprising:

a reaction chamber including a workpiece holder positioned relative to a plasma zone in the chamber, an energy source configured to generate a plasma energy and direct the plasma energy toward the plasma zone, and a window transmissive of the plasma energy between the energy source and the plasma zone;

a process gas supply unit containing first and second process gases selected to react with each other to form a conductive material, wherein the process gas unit is configured to deliver at least one of the first and second gases to the plasma zone to deposit the conductive material on the workpiece;

a maintenance gas unit containing a maintenance gas selected to increase a transmissivity of the conductive material formed by reacting the first and second gases to the plasma energy, wherein the maintenance gas unit is configured to deliver the maintenance gas to the window; and

a controller coupled to the process gas unit and the maintenance gas unit, the controller containing computer operable instructions causing (a) the first and second gases to be injected into the chamber in a manner that deposits the conductive material onto the workpiece, and (b) the maintenance gas to be injected into the chamber in a manner that increases the transmissivity of the conductive material deposited onto the window to the plasma energy.

[c26] 26. The apparatus of claim 25 wherein the conductive material resulting from reacting the first and second process gases comprises a metal, and the maintenance fluid comprises oxygen for transforming the conductive material on the window into a substantially dielectric material by changing the metal to an oxide.

[c27] 27. The apparatus of claim 25 wherein the conductive material resulting from reacting the first and second process gases comprises at least one of Ti, Cu, Al, Ni and/or Co, and the maintenance fluid comprises oxygen for transforming the conductive material into a substantially dielectric material comprising an oxide of Ti, Cu, Al, Ni and/or Co.

[c28] 28. The apparatus of claim 25 wherein the controller contains computer readable instructions to inject the first and second process gases into the chamber at a deposition temperature and to inject the maintenance fluid into the chamber at a maintenance temperature of approximately 80% to 120% of the deposition temperature.

[c29] 29. The apparatus of claim 25 wherein the controller contains computer readable instructions to inject the first and second process gases into the chamber at a deposition temperature and to inject the maintenance fluid into the chamber at a maintenance temperature of approximately 95% to 105% of the deposition temperature.

[c30] 30. The apparatus of claim 25 wherein the controller contains computer readable instructions to inject the first and second process gases into the chamber at a deposition temperature and to inject the maintenance fluid into the chamber at a maintenance temperature approximately equal to the deposition temperature.

[c31] 31. The apparatus of claim 25 wherein the controller contains computer readable instructions to inject the first and second process gases into the chamber at a deposition temperature and to inject the maintenance fluid into the chamber at a maintenance temperature within approximately 50°C of the deposition temperature.

[c32] 32. An apparatus for depositing a material onto a microfeature workpiece, comprising:

a reaction chamber including a workpiece holder positioned relative to a plasma zone in the chamber, an energy source configured to generate a plasma energy and direct the plasma energy toward the plasma zone, and a window transmissive of the plasma energy between the energy source and the plasma zone; and

a controller coupled to a process gas unit and a maintenance gas unit, the controller containing computer operable instructions that cause (a) a first gas and a second gas to be injected into the chamber in a manner that deposits a conductive material onto the workpiece and a residual conductive material onto the window, and (b) a maintenance gas to be injected into the chamber in a manner that reacts with the residual conductive material on the window to increase the transmissivity of the residual conductive material to the plasma energy.

[c33] 33. The apparatus of claim 32 wherein the conductive material deposited on the workpiece and the window comprises a metal, and the maintenance gas comprises oxygen for transforming the metal into an oxide.

[c34] 34. The apparatus of claim 32 wherein the conductive material deposited on the workpiece comprises at least one of Ti, Cu, Al, Ni and/or Co, and the maintenance gas comprises oxygen for transforming the conductive material into an oxide of at least one of the Ti, Cu, Al, Ni and/or Co.

[c35] 35. The apparatus of claim 32 wherein the controller contains computer readable instructions to inject the first and second process gases into the chamber at a deposition temperature and to inject the maintenance fluid into the chamber at a maintenance temperature of approximately 80% to 120% of the deposition temperature.

[c36] 40. The apparatus of claim 35 wherein the controller contains computer readable instructions to inject the first and second process gases into the chamber at a deposition temperature and to inject the maintenance fluid into the chamber at a maintenance temperature of approximately 95% to 105% of the deposition temperature.

[c37] 41. The apparatus of claim 35 wherein the controller contains computer readable instructions to inject the first and second process gases into the chamber at a deposition temperature and to inject the maintenance fluid into the chamber at a maintenance temperature approximately equal to the deposition temperature.

[c38] 42. The apparatus of claim 35 wherein the controller contains computer readable instructions to inject the first and second process gases into the chamber at a deposition temperature and to inject the maintenance fluid into the chamber at a maintenance temperature within approximately 50°C of the deposition temperature.